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Composition of the Essential Oils of *Salvia leriifolia* Benth. Growing Wild in Around of Two Mine in Iran

[1]A. Monfared and [2]M. Ghorbanli
[1]Department of Chemistry, Payame Noor University, Tehran Centre, P.O. Box 15887-65633, Tehran, Iran
[2]Department of Biology, Islamic Azad University, Gorgan Branch, Gorgan, Iran

Abstract: The oils of the aerial parts of *Salvia leriifolia* Benth. collected from around of two mines (copper and iron) of Bardscan town in Kashmar city was analyzed by GC/MS, the oils obtained upon hydrodistillation were 0.28 and 0.35% on dry weight basis, respectively. As the result of analysis of the oils was identification of 32 constituents totaling 100% from the first oil (copper mine) and 12 components by 96.94% of other oil (iron mine). The main compounds were 1,8-cineole (20.04%), camphor (18.48%), α-pinene (16.49%) and camphene (10.94%) from copper mine and artemisia ketone (62.92%) and cubenol (9.35%) from iron mine. By comparing with previous studies, we obtained different results, that may be because of the effects of pollutant of minerals of mine areas.

Key words: *Salvia leriifolia*, Lamiaceae, essential oil composition, artemisia ketone, 1,8-cineole, camphor, α-pinene

INTRODUCTION

Salvia is an important genus consisting about 900 species in the family of Lamiaceae (Rechinger, 1982). Some species of *Salvia* used in folk medicine for culinary purposes (Imanshahidi and Hosseinzadeh, 2006). In this study, there are many references about pharmacological effects of *S. leriifolia* as: sedative and hypnotic (Hosseinzadeh and Imanshahidi, 1999) antihyperglycemic effect (Hosseinzadeh *et al*., 1998) skeletal muscle relaxant (Hosseinzadeh and Hassanzadeh, 2001), analgesic and anti-inflammatory (Hosseinzadeh *et al*., 2003; Hosseinzadeh and Yavary, 1999), anticonvulsant (Hosseinzadeh and Arabsanavi, 2001) neuroprotective (Hosseinzadeh *et al*., 2002; Sadeghnia *et al*., 2003; Khooei *et al*., 2003) inhibition of opioid and withdrawal syndrome (Hosseinzadeh and Lari, 2000) and anti-ulcer effect (Hosseinzadeh *et al*., 2000). *Salvia leriifolia* named Noruzak in persian and effect of ethanolic and aqueous extraction from roots of Noruzak was investigated on lipids in global cerebral ischemia (Khooei *et al*., 2003; Sadeghnia *et al*., 2003) and effect of aqueous and ethanolic extracts of root of *S. leriifolia* has been shown to decrease Ischemia-Reperfusion (I/R) injury in brain tissues on animal model of I/R injury in the rat hind limb (Hosseinzadeh *et al*., 2007). However, in recent years much attention has been directed to the biological activity, water-soluble components in the dried root decoction of the *salvia* plants (Imanshahidi and Hosseinzadeh, 2006). *In vitro* biological activity of *S. leriifolia* Benth. essential oil relevant to the treatment of Alzheimer's disease (Loizze *et al*., 2009). Habibi *et al*. (2000) reported structure and antibacterial activity of p6 new labdane diterpenoid from *S. leriifolia*.

Corresponding Author: Aazam Monfared, Department of Chemistry, Payame Noor University, Tehran Centre, P.O. Box 15887-65633, Tehran, Iran

In this study the effects of natural tension, effects of copper and iron mines on the constituents of the oils of *Salvia leriifolia* were studied and compared with two only before considered as the blank (Rustaiyan *et al*., 2000, 2007).

MATERIALS AND METHODS

Plant Material

The aerial parts of *S. leriifolia* Benth. were collected from 37 km Bardscan town in Kashmar city names to Taknar copper and Southwest of Bardscan town between Dlacan, Kale Asb, Aghel Kaftar mountains names to Dehzaman iron in Korassan Razavi Province in Iran, in Spring 2007. The voucher specimens have been deposited at the Herbarium of Agricultural Faculty in Ferdosi University Mashad, Iran.

Oil Isolation

The oils of air-dried of aerial parts of *S. leriifolia* from copper mine region (50 g), iron mine region (63 g) were obtained by hydrodistillation method, Clevenger-type apparatus for 2.5 and 2 h, with yields 0.28% green and 0.35% yellow, respectively. The oils dried over anhydrous sodium sulphate.

GC/MS

GC analysis was performed using a Hewlett-Packard 6890 with HP-5MS column (30 m×0.25 mm, film thickness 0.32 μm) and coupled with MS, HP-5973. The injection temperature was 250°C. The oven temperature was kept at 60°C for 2 min, promoted to 220°C at 6°C min^{-1} and kept constant at 220°C for 2 min. The carrier gas was Helium (99.999%) in a flow rate of 1 mL min^{-1}. Ionization energy of MS were 70 eV.

Identification of the constituents of the oils were made by comparison of their mass spectra and Retention Indices (RI) with those given in the literature and those authentic samples (Adams, 1995).

RESULTS AND DISCUSSION

The chemical composition of the oils of *S. leriifolia* can be seen in Table 1. Among the 32 compounds (100% of total percent) characterized from copper mine's oil monoterpenes were dominant (34.87% hydrocarbon and 52.87% oxygenated monoterpenes) which 1,8-cineole (20.04%), camphor (18.48%), α-pinene (16.49%) and camphene (10.94%) were the main constituents and 12 compounds identified from iron mine's oil (96.94% of total percent), oxygenated monoterpenes with artemisia ketone (62.92%) and cubenol (9.35%) as a sesquiterpene were the major ones.

There was only report about composition of the essential oil of *S. leriifolia* (Rustaiyan *et al*., 2000) that hydrocarbon monoterpenes were dominant and β-pinene (23.7%) 1,8-cineole (16.2%), α-pinene (13.8%) and α-cadinol (9.0%) characterized as the main from 22 compounds. And in the searching on internet, there was one abstract from the other work of Rustaiyan's teams that reported stem oil consisted mainly both monoterpenes (β-pinene (19.0%)) and sesquiterpenes (germacrene-D (11.0%) and δ-cadinene (10.05%) from 34 compounds by 92.4% total identified), while leaf and flower oils monoterpenes (β-pinene (31.5%), 1,8-cineole (24.7%) and α- pinene (17.5%) in the leaf among 30 components by 98.9% and γ-terpinene (62.2%) and para cymene (11.1%) in flowers oil from 27 compounds (95.9%)) predominated over sesquiterpenes (Rustaiyan *et al*., 2007). In comparing present results

Table 1: Comparing the composition of the oils of *S. leriifolia* (copper mine and iron mine)

Compounds	Area (% copper mine)	Area (% iron mine)
Tricyclene	0.75	---
α-thujene	0.27	---
α-pinene	16.49	---
Camphene	10.94	---
Sabinene	0.17	---
β-pinene	3.76	---
Myrcene	0.81	---
Yomogi alcohol	---	2.21
δ-3-carene	---	---
α-terpinene	0.3	---
p-cymene	0.41	---
1,8-cineole	20.04	6.04
(Z)-β-ocimene	---	---
(E)-β-ocimene	---	---
γ-terpinene	0.48	---
Artemisia ketone	---	62.92
Artemisia alcohol	---	2.03
Terpinolene	---	---
(E,E)-allo-ocimene	---	---
Camphor	18.48	---
Borneol	4.83	---
Lavandulol	---	3.76
4-terpineol	0.74	---
Unknown	---	0.73
α-terpineol	2.04	---
Methyl chavicol	1.04	---
Bornyl acetate	5.7	---
α-ylangene	0.42	---
α-copaene	0.22	---
Geranyl acetate	---	0.31
β-caryophyllene	3.1	---
Lavandulyl isobutyrate	---	0.48
Calarene	2.01	---
α-humulene	1.94	---
γ-muurolene	0.8	---
Germacrene-D	0.39	---
α-muurolene	---	---
Lavandulyl isovalerata	---	7.53
γ-cadinene	0.35	---
δ-cadinene	1.39	---
γ-dehydro-ar-himachalene	---	0.3
α-cadinene	0.32	---
α-calacorene	0.31	---
Caryophyllene oxide	0.38	0.25
Unknown	---	1.35
Humulene epoxide (II)	0.26	---
T-muurolol	---	---
Cubenol	0.22	9.35
α-cadinol	---	---
β-eudesmol	0.62	---
Kongol	---	1.76
Unknown	---	0.34
Unknown	---	0.64
Total identified	(32 compounds) 100 (%)	(12 compounds) 96.94 (%)

with two before mentioned references (Rustaiyan *et al*., 2000, 2007) we can also see mainly monoterpenes, but with different quality and quantity of the compounds, for example β-pinene before found as the major in stem and leaf oils but now in the oil of copper mine 1, 8-cineol as the major and in the oil of iron mine artemisia ketone be the major and γ-terpinene in the flower oil of before result was major (62.2%) but in present result only in the copper mine oil find as a trace amount (0.48%), that may be because of different date and area of harvesting or effects of pollutants minerals. Also, there were different results within two mines (copper and iron), artemesia ketone (62.92%) was seen only in the iron mine's oil, while 1, 8-cineole (20.04%), camphor (18.48%), α-pinene (16.9%) and camphene (10.94%) were majors in the copper mine's oil.

Imanshahidi and Hosseinzadeh (2006) noted that despite of showing good pharmacological or therapeutic effects, there is still a need for more precise studies to determine and separate the active compounds and elucidate their mechanisms of action. So we conclude that, in spite of study on the pollutant area and different results with others in quality and quantity of compounds, this is not enough and the investigation must be continued to expand knowledge about active compounds and on elucidation significant structures.

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